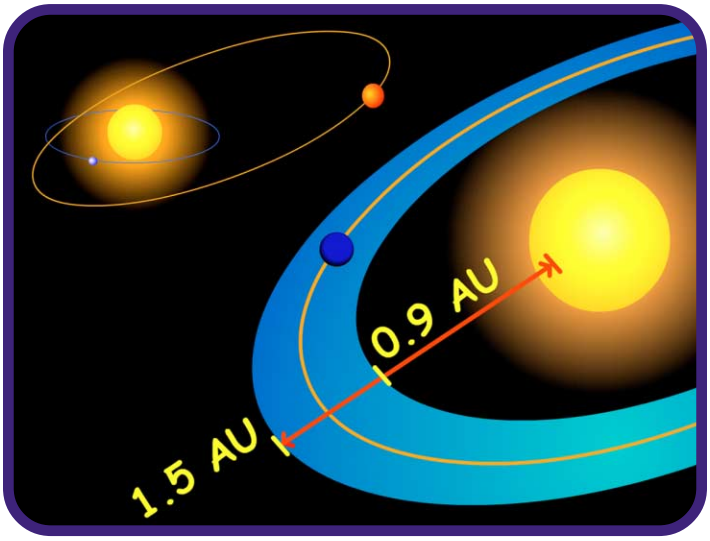
Habitable Zone Reading



What is the Habitable Zone?

Life as we know it needs liquid water to survive. The Habitable Zone is the distance from a star where liquid water can exist on a planet's surface. If a planet is too far from its star, water freezes. If a planet is too close to its star, water evaporates. A planet must stay in the Habitable-Zone throughout its orbit in order for water to remain a liquid.

Where is the Habitable Zone?

The distance at which a planet can have water is determined by how much energy is given off by the star. This distance is measured in astronomical units or AU. An astronomical unit is the average distance from Earth to the Sun, which is equal to 149,598,770 km or 93,000,000 miles. For cooler red dwarfs, the Habitable Zone is so close to the star that solar flares and radiation from the star would destroy life. For very hot blue stars, the Habitable Zone is further away. These stars tend to burn at such high temperatures that they have very short lives, lasting only a few million years. (It took 700 million years for life to become established on Earth). Our Sun's Habitable Zone for larger life forms including humans is between 0.9 AU to 1.5 AU.

Is the Habitable Zone always in the same place?

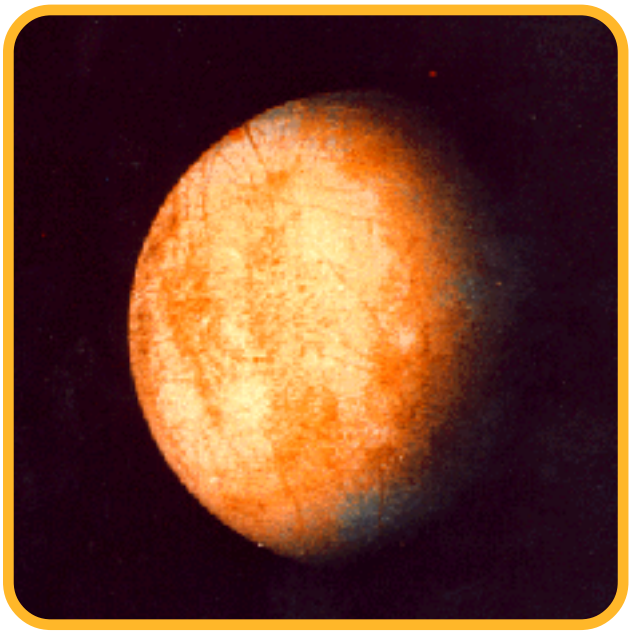
The Habitable Zone can move as a star changes. As a star grows older, it grows hotter causing the zone to mover further away from the star. At one time, Earth was on the outer edge of the Sun's Habitable Zone, but now the zone has moved further away, so Venus is no longer in the Habitable Zone. Since stars change, it is important to have a star has a temperature that stays about the same for a long time. It's also important that the orbit of an Earth-size planet be in the area of the zone that remains in the zone as the zone changes.

If I'm in the Zone, is Survival Guaranteed?

Even if a planet is in the Habitable Zone throughout its entire orbit, human survival is not guaranteed. The planet may not even have water on it to begin with, or the water it has may not be liquid. Mars, for example, has such a low surface pressure that its water cannot be a liquid on the surface. Water goes from a solid to a gas without ever being liquid.

Also, the planet may not have the right kind of atmosphere and may not be the right size to hold on to the atmosphere that humans need. Without the right kind of atmosphere to trap heat and maintain a stable temperature, surface water would not be found on a planet. Furthermore, the planet may not host plant and animal life that humans can eat. Finally, there may be other dangers, such as large planets, solar flares or radiation, from which humans need protection.

Is the Habitable Zone the same for all life?



Jupiter's moon, Europa

The Habitable-Zone for **microbes** is much larger than the Habitable-Zone for humans, because microbes can survive under conditions that humans cannot. A microbe is an animal or plant so small it can be seen only with a **microscope**. A bacterium is an example of a microbe. There are microbes that can survive in the frozen ice of Antarctica and in the extremely hot, thermal vents on the ocean floor. That's why scientists are looking for life on Mars and one of Jupiter's moons, **Europa**.

Questions

(Answer on a separate sheet of paper)

1. What is the definition of Habitable Zone?
2. Are all stars' Habitable Zones at the same distance? Why or why not?
3. What would happen if a planet weren't in the Habitable Zone?
4. Would a microbe's Habitable Zone be closer or further from a star than a human's Habitable Zone? Explain your answer.